Patent
Attorney's Docket No. 1030681-000642

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	**Mail Stop Amendment**
Youn-joon Sung et al.	Group Art Unit: 2828
Application No.: 10/813,157	Examiner: RORY B FINNEREN
Filed: March 31, 2004	Confirmation No.: 4476
For: LASER DIODE AND METHOD OF MANUFACTURING THE SAME USING SELF-ALIGN PROCESS	

AMENDMENT

Commissioner for Patents
P.O. Box 1450
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Sir:

In response to the final Office Action dated April 30, 2008, please amend the above-identified patent application as follows:

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

1. (Currently Amended) A laser diode comprising:

a substrate;

a lower material layer formed on the substrate;

a resonance layer formed on the lower material layer;

an upper material layer formed on the resonance layer and having a ridge at the top;

a buried layer formed on the upper material layer and having a contact hole corresponding to the ridge of the upper material layer;

a protective layer formed on the buried layer and having a material different from the material of the buried layer, and having an opening corresponding to the contact hole of the buried layer; and

an upper electrode formed on the protective layer to contact an upper surface of the ridge through the contact hole, wherein the upper surface of the ridge is planar such that the upper electrode is in direct contact with each of the contact hole, buried layer, and protective layer.

2. (Original) The laser diode of claim 1, wherein the lower material layer includes:

a first compound semiconductor layer stacked on the substrate; and

a lower cladding layer stacked on the first compound semiconductor layer.

3. (Original) The laser diode of claim 2, wherein the first compound semiconductor layer is an n-GaN based group III-V nitride semiconductor layer.

4. (Original) The laser diode of claim 2, wherein the lower cladding layer is an n-GaN/AlGaN layer.

5. (Original) The laser diode of claim 1, wherein the resonance layer further includes:

a lower waveguide layer stacked on the lower cladding layer and having a refractive index larger than that of the lower cladding layer;

an active layer stacked on the upper surface of the lower waveguide layer to generate a laser beam; and

an upper waveguide layer stacked on the active layer.

6. (Original) The laser diode of claim 5, wherein the refractive indexes of the upper and lower waveguide layers are lower than the refractive index of the active layer.

7. (Original) The laser diode of claim 5, wherein the active layer is a GaN based group III-V nitride compound semiconductor layer of $In_xAl_yGa_{1-x-y}N$ where $0 \leq x \leq 1$, $0 \leq y \leq 1$, and $x+y \leq 1$.

8. (Original) The laser diode of claim 1, wherein the upper material layer includes:

an upper cladding layer stacked on the upper waveguide layer and having the ridge and a refractive index smaller than that of the upper waveguide layer; and

a second compound semiconductor layer formed on the ridge.

9. (Original) The laser diode of claim 8, wherein the upper cladding layer is a p-GaN/AlGaN layer.

10. (Original) The laser diode of claim 8, wherein the second compound semiconductor layer is a p-GaN based group III-V nitride semiconductor layer.

11. (Currently Amended) A manufacturing method of a laser diode, the method comprising:

forming a laser oscillating structure including a substrate, a resonance layer on the substrate, and cladding layers formed on and under the resonance layer and having a ridge protruding to a predetermined height;

forming a buried layer on top of the structure to cover the surface of the ridge;

sequentially forming a protective layer and an etch back material layer on the surface of the buried layer;

etching the etch back material layer by an etch back process to a predetermined depth to expose a portion of the protective layer at the upper direction of the ridge;

removing the portion of the protective layer, which is not covered by the etch back material layer, by using an etchant to form an opening which exposes a portion of the surface of the buried layer on the ridge;

removing the etch back material layer remained remaining on the buried layer;

forming a contact hole by etching the portion of the buried layer, which is exposed through the opening of the protective layer, wherein the upper surface of the ridge is planar such that the upper electrode is in direct contact with each of the contact hole, buried layer, and protective layer; and

forming an upper electrode that contacts to the top surface of the ridge through the contact hole on the protective layer.

12. (Original) The method of claim 11, wherein the forming of the layer oscillating structure further includes:

forming a lower material layer including a lower cladding layer, on the substrate;

forming a resonance layer including an active layer, on the lower material layer; and

forming an upper material layer, which includes an upper cladding layer and a contact layer and having the ridge protruding to a predetermined height, on the resonance layer.

13. (Original) The method of claim 11, wherein the forming of the lower material layer further includes:

forming a first compound semiconductor layer on the substrate; and

forming the lower cladding layer on the first compound semiconductor layer.

14. (Original) The method of claim 13, wherein the first compound semiconductor layer is formed of n-GaN based group III-V nitride.

15. (Original) The method of claim 13, wherein the lower cladding layer is formed of n-GaN/AlGaN.

16. (Original) The method of claim 11, wherein the forming of the resonance layer further includes:

forming a lower waveguide layer having a refractive index larger than that of the lower cladding layer, on the lower cladding layer;

forming an active layer that generates a laser beam, on the lower waveguide layer; and

forming an upper waveguide layer on the active layer.

17. (Original) The method of claim 16, wherein the upper and lower waveguide layers are formed of materials having refractive indexes smaller than that of the active layer.

18. (Original) The method of claim 17, wherein the upper and lower waveguide layers are formed of GaN based group III-V compound.

19. (Original) The method of claim 16, wherein the active layer is formed of GaN based group III-V nitride compound of $In_xAl_yGa_{1-x-y}N$ where $0 \leq x \leq 1$, $0 \leq y \leq 1$, and $x+y \leq 1$.

20. (Original) The method of claim 12, wherein the forming of the upper material layer further includes:

forming an upper cladding layer having a refractive index smaller than that of the upper waveguide layer, on the upper waveguide layer; and

forming a second compound semiconductor layer on the upper cladding layer.

21. (Original) The method of claim 20, wherein the upper cladding layer is formed of p-GaN/AlGaN.

22. (Original) The method of claim 20, wherein the second compound semiconductor layer is formed of p-GaN based group III-V nitride.

23. (Original) The method of claim 11, further including forming a lift-off layer having an opening at a portion corresponding to the ridge, on the second material layer, after the etch back material layer is removed and before the contact hole is formed.

REMARKS

This communication is a full and timely response to the final rejection dated April 30, 2008. By this communication, claims 1 and 11 are amended. Claims 1-23 remain pending. Reconsideration and allowance of this application are respectfully requested.

Rejections Under 35 U.S.C. §102

Claims 1-23 stand rejected under 35 U.S.C. §102(b) as anticipated by *Kozaki* (U.S. Patent Pub. No. 2002/00536760). Applicants respectfully traverse this rejection.

Each of Applicants' claims 1 and 11 recite, among other features, an upper electrode formed on a protective layer to contact an upper surface of a ridge through a contact hole, wherein the upper surface of the ridge is planar such that the upper electrode is in direct contact with each of the contact hole, buried layer, and protective layer.

Kozaki fails to anticipate applicants' claims because it does not disclose or suggest every element or combination of elements recited therein. On page 2 of the Office Action, the PTO contends that *Kozaki* illustrates the upper electrode is in contact with the buried layer through its contact or relationship with the lower electrode and buried layer. This argument is an effective acknowledgement that the upper electrode does not directly contact the buried layer. The structural configuration of *Kozaki* shown in Fig. 1 illustrates that the upper electrode indirectly contacts the buried layer through the lower electrode. As a result, *Kozaki* does not establish a *prima facie* case of anticipation with respect to Applicants' claimed embodiments.

The Examiner is reminded that to properly anticipate a claim, the document must disclose, explicitly or implicitly, each and every feature recited in the claim. *See* Verdegall Bros. v. Union Oil Co. of Calif., 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Based on at least the foregoing reasons, Applicants respectfully request that the rejection to claims 1 and 11 and their corresponding dependent claims be withdrawn.

Conclusion

Based on at least the foregoing amendments and remarks, Applicants submit that claims 1-23 are allowable, and this application is in condition for allowance. Accordingly, Applicants request favorable examination and consideration of all pending claims. In the event the instant application can be placed in even better form, Applicants request that the undersigned attorney be contacted at the number below.

Respectfully submitted,

BUCHANAN INGERSOLL & ROONEY PC

Date: July 29, 2008

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